FBSB DURABILITY

TEST SET

EQUIPMENT MANUAL

PREPARED BY
TECHNICAL SERVICES
INFORMATION AND AUTOMATION
SERVICES DIVISION

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FBSB DURABILITY
TEST SET

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AUTOMATION SYSTEMS MANUFACTURING

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1. GENERAL DESCRIPTION

1.1 Introduction:

The FBSB Durability Test Set is designed to test the reliability of the Fisher Body Seat Belt (FBSB) device during extended operational periods and under varying temperature environs. The test set simultaneously tests 20 FBSB devices in repetitive 20-second operational cycles (180 tests per hour). The air temperature surrounding the devices and the duration of a constant temperature application is selected by operation personnel. The degree and duration is normally -40°F for 60 minutes and 160°F for 30 minutes. The device environment is established in a Delta Design Chamber that is remote from the Test Unit. The Test Unit simulates the automobile occupants sitting down and fastening and unfastening the seat belts. A visual display is provided to indicate the number of successful operations each FBSB device has performed.

1.2 Specifications:

1.2.1 Accuracy:

The Test Set will test the accuracy of 999,999 correct operational cycles of each FBSB device.

1.2.2 Physical Description:

The FBSB Durability Test Set consists of two separate units: the Test Unit and the Environmental Chamber.

1.2.2.1 Machine Demensions: Test Unit - 44" High, 24" Wide, 24" Deep

1.2.2.2 Weight: Approximately 100 pounds

1.2.2.3 Color: Gray

2. OPERATION

Two procedures must be performed to place the Durability Test Set into operation; an initialization procedure and an operation procedure. The initialization procedure verifies and/or establishes the testing temperature and duration of constant temperature application. This procedure is normally performed by the responsible Production and Equipment Maintenance personnel. The operation procedure, contained in Table 2-1, describes the insertion of FBSB devices into the Environmental Chamber and the Test Unit turn-on.

Table 2-1. Operating Procedure

STEP	ACTION	RESULT
1	Open Environmental Chamber door.	
2	Connect each of the 20 FBSB devices to connectors P1 and P2 and place the devices on the bracket inside the chamber.	Devices electrically connected to Test Unit
3	Close Environmental Chamber door.	
4	Turn on the Environmental Chamber.	
5	Set the 20 Test Unit mechanical counters to 0's.	
6	Set the Test Unit circuit breaker to the ON position.	The Test Set operates in a continuous cycle of testing FBSB devices.

Once turned-on the operation of the Durability Test Set is fully automatic. The operator may monitor the Test Unit indicating lamps associated with each device under test to ensure proper operation of the no-start (right lamp) and buzzer alarm (left lamp) functions of the FBSB device. The counter associated with each device indicates the number of successful no-start conditions detected by the device (one no-start condition is generated by a correctly operating unit under test each 20-second cycle). The Test Unit may be stopped or restarted at any time by actuating the main circuit breaker. A complete shutdown is accomplished by setting the Test Unit's main circuit breaker to the OFF position and turning off the Environmental Chamber.

3. EXTERNAL EQUIPMENT REQUIRED

No special tools or equipment are required for the normal operation or setup of the FBSB Durability Test Set.

4. SETUP AND CALIBRATION

4.1 Setup:

Setup is performed by the operator. The setup consists of setting the Environmental Chamber controls and indicators to establish testing temperature parameters and ensuring the test set power supply is adjusted to furnish 16Vdc (±.5V). The Production Equipment Maintenance group responsible for maintaining the unit determines the procedure to be followed to set up the test set.

4.2 Calibration:

The test set has been calibrated prior to delivery and there is no requirement to periodically re-calibrate.

5. THEORY OF OPERATION

5.1 General:

The FBSB (Fisher Body Seat Belt) Durability Test Set tests the durability of 20 FBSB devices at low (-40°F) and high (160°F) temperatures. The Test Set consists of two separate units; a Test Unit and an Environmental Chamber. The Test Unit controls the operation of the devices being tested and monitors via indicator lamps and mechanical counters the outputs of the FBSB devices. In this manner a count is maintained of the number of successful operations each of the devices has performed.

The Environmental Chamber controls the temperature at which the devices are to be tested. The twenty FBSB devices are placed inside the chamber and are electrically connected to the Test Unit by a cable. The Environmental Chamber operates independent of the Test Unit.

5.2 Test Unit:

The Test Unit completes one testing cycle every 20 seconds. The cyclic rate of the unit is determined by the timing control circuitry located on a logic board in the unit. The timing control function is described in paragraph 5.2.1. The Test Unit provides input signals (seat and seat belt) to the FBSB devices by the use of two relays described in paragraph 5.2.2. "Seat and Seat Belt Relay Control". The FBSB device output signals are received and recorded by the Test Unit relay/counter control circuit described in paragraph 5.2.3.

5.2.1 Timing Control:

The timing control circuit provides the timing pulses that control the 20-second operation cycle of the Test Set. The circuit outputs 20 sequential pulses of approximately 900 milliseconds duration for each operational cycle. The pulses are used to light the operation sequence indicator lights on the front of the Test Unit and to enable the energizing and de-energizing of the seat belt and seat relays K61 and K62. The circuit is located on a logic board inside the Test Unit.

The input to the timing circuit is a 2.5 volt, 60-Hz rectified waveform received from transformer T1. The Schmitt trigger circuit of IC package 1 shapes the input signal into TTL compatible logic levels. Refer to the timing circuit wiring diagram contained in section 7 and Figure 6-1 for IC package designations and locations. The 60-cycle pulse is supplied to a divide-by-5 circuit (IC package 5) and the resultant 12-cycle pulse is supplied to a divide-by-12 circuit (IC package 6). The product of the divide circuits (one pulse every second) is applied to each of two 4-bit binary counters (IC packages 7 & 8). IC package 7 controls the time intervals (pulses) 2 through 10 and IC package 8 the intervals 12 through 20. Time intervals 1 and 11 are generated by logic in IC package 4. This is performed to prevent a 1 and 11 time interval from being decoded by the BCD decoder every time the counters are reset (an all "0" condition in the 4-bit binary counters). The resetting of the counters is controlled by IC package 2 for the 2 through 7 count and IC package 3 for the 12 through 20 count. Two BCD to decimal decoder circuits (IC packages 9 & 10) decode the outputs of the 4-bit binary counters. Each decoded output (except all "0") is furnished to a driver package. The driver circuits serve as indicator and relay drivers for the timing indicator lamps (20) and seat and seat belt control relays K61 and K62.

5.2.2 Seat and Seat Belt Relay Control:

Refer to the Test Set schematic (sheet 1) contained in section 7 while reading this paragraph. The seat and seat belt relay control circuitry is located on a small circuit board inside the Test Unit. Basically, it consists of two identical circuits; one to simulate automobile occupants sitting or not sitting in the automobile and the other simulating the fastening and unfastening of the seat belts.

Each circuit is comprised of three transistors and a relay. Input pulses are received from the Timing Control circuit at predetermined intervals in the 20-second operation cycle. The seat belt simulation is as follows: At the 2-second interval of the operation cycle, a negative going pulse is applied to the base of transistor Q1. Transistor Q1 turns off resulting in the turn-on of Q2 and the application of +16 volts to relay

coil K61. Relay K61 energizes and locks in through its holding contact. The SEAT BELT indicator on the front panel of the Test Unit also illuminates. Another set of relay K61 contacts close and furnish a signal (seat belt fastened) to all the FBSB devices under test. Relay K61 remains energized until 10 seconds have elapsed from the start of the cycle. At this time the Timing Control circuit applies a negative going pulse (approximately 900 milliseconds) to the base of transistor Q3. Transistor Q3 turns off removing ground from relay coil K61 and de-energizes the relay. The circuit now simulates a seat belt unfastened condition. This operation is repeated during a cycle at the 15 and the 17 second timing intervals. Refer to the timing diagram in Figure 5-1.

The operation of the circuit for the seat is the same as described in the preceding paragraph. The seat circuit consists of transistors Q4, Q5 and Q6, and relay K62. Relay K62 is energized at the 5-second time interval and de-energizes at the end of the cycle (20-second interval).

5.2.3 Relay/Counter Control:

The relay/counter control function consists of twenty identical circuits. Each circuit monitors the operation of an associated FBSB device. With the FBSB device operating correctly, input signals to the circuit energize the no-start relay K21 at the beginning of an operation cycle and de-energize the relay at the 15-second time interval. Relay K21 contacts close energizing the mechanical counter coil K1 and thereby increment the counter count by 1. The right indicating lamp also is lit during the 15-second interval. The buzzer (warning function) coil K41 and indicating lamp on the left side are energized at the cycle time intervals of 5 seconds to 15 seconds and again from 17 seconds to 20 seconds. Refer to the timing diagram in Figure 5-1.

5.3 Environmental Chamber:

The Environmental Chamber is a Delta Design unit. Refer to the Delta Design Operation and Maintenance Manual for details. To test the FBSB devices, the unit is presently set up to maintain a low temperature of -40°F (±10%) for ~~60~~ 30 minutes and a high temperature of 160°F (±5%) for ~~30~~ 60 minutes. The temperature rise time from -40°F to 160°F is 5 minutes and the fall time of 160°F to -40°F is 5 minutes.

Changes Per REV. B
LB 1/29/74

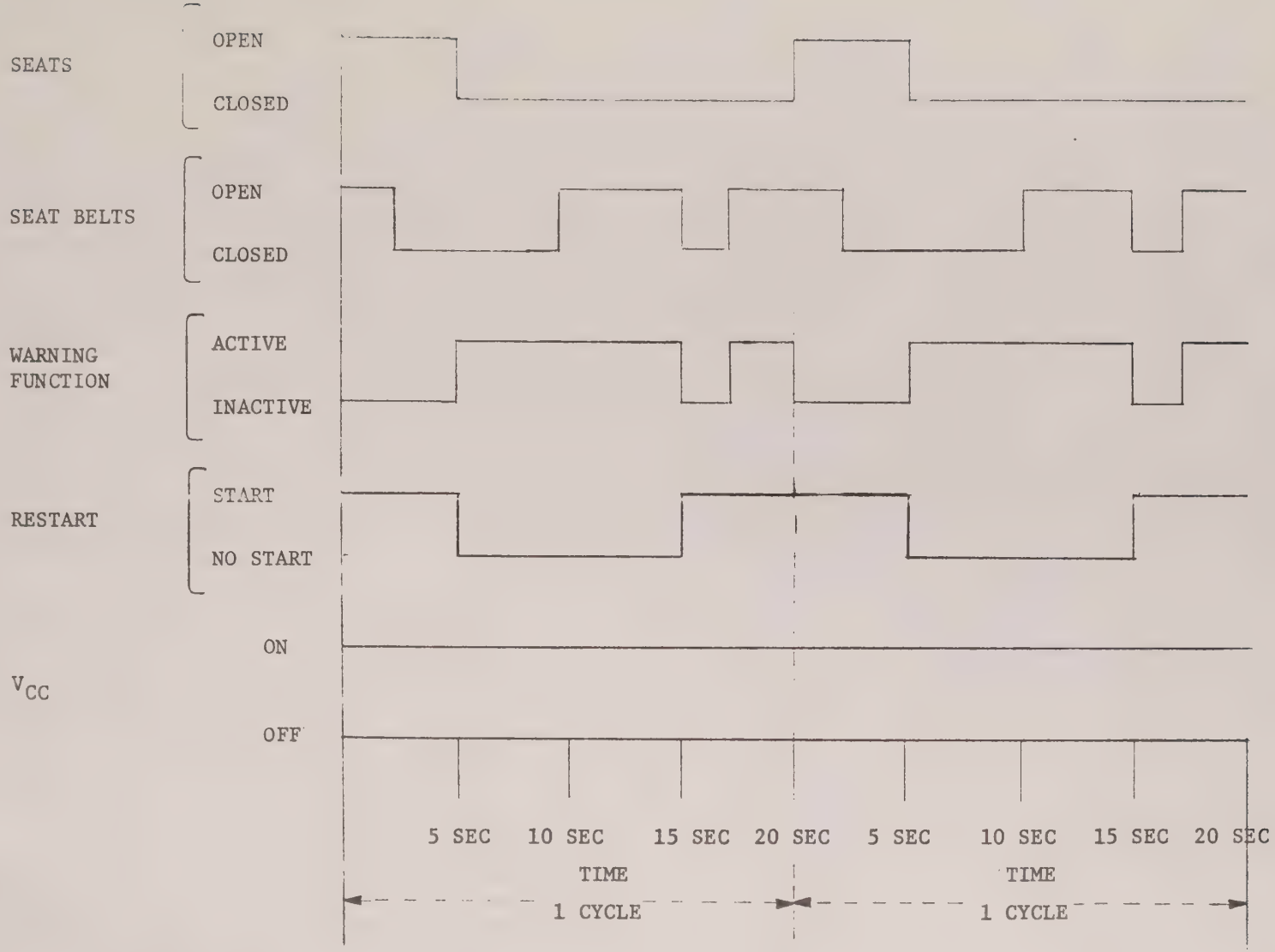


Figure 5-1: Timing Diagram

6. MAINTENANCE

6.1 Installation Requirements:

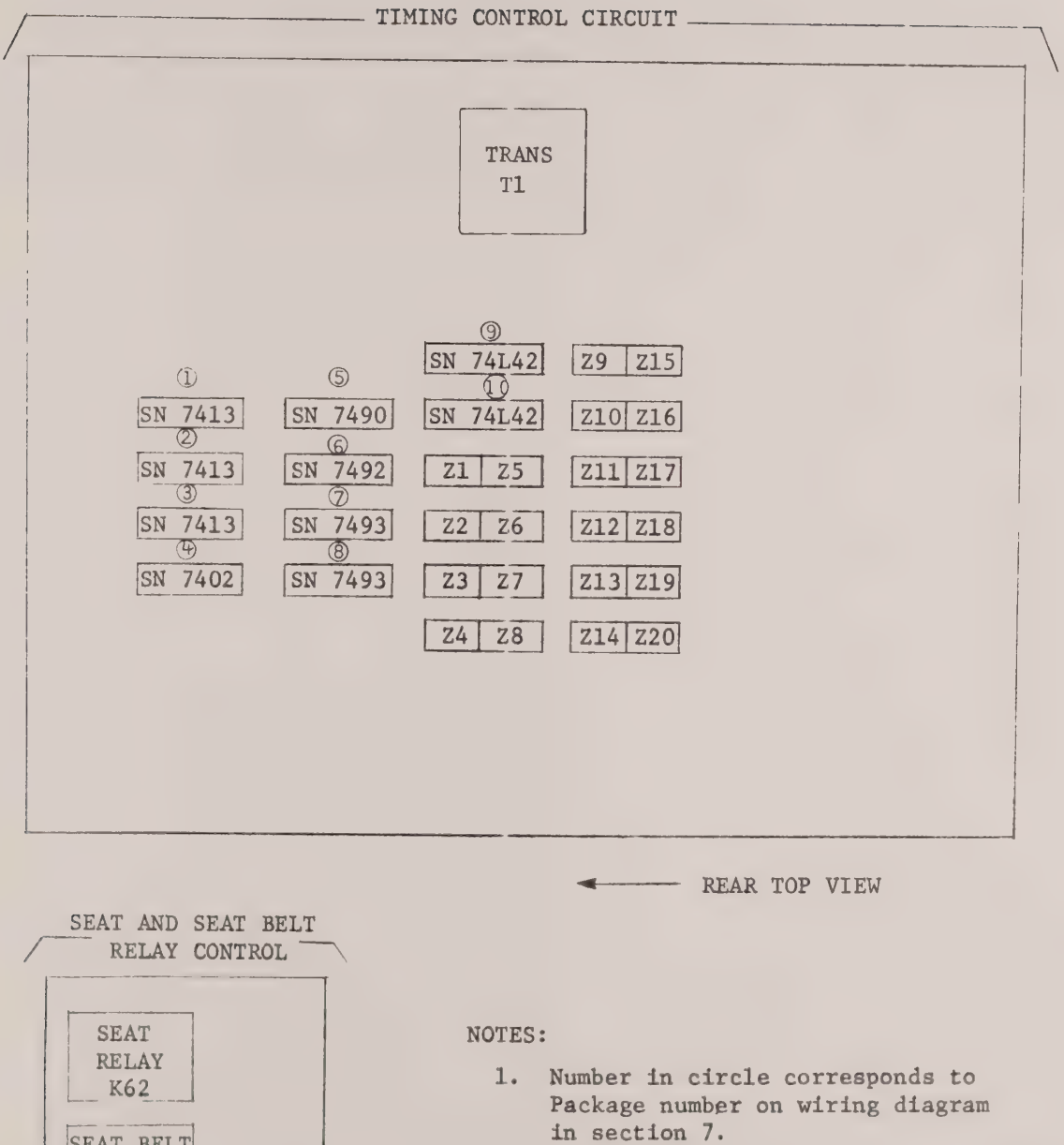
Electrical: Test Unit - 120-Volts, 60-Hz, 1-phase at 20 amperes

6.2 Recommended Spares:

Light Bulb, 1816	20 each
Relay, Delco, 1116992	1 each
Mechanical Counter, Redington, Cat 9-1006-12 VDC, Model #100 6D.9	1 each

6.3 Troubleshooting:

Test Unit Component Locations: Thirty dual-in-line IC packages mounted on a logic board comprise the Test Unit timing circuit. The board layout is illustrated in Figure 6-1. The location of the "seat belt" and "seat" relays is also indicated in Figure 6-1.



NOTES:

1. Number in circle corresponds to Package number on wiring diagram in section 7.
2. IC Packages Z1 thru Z20 are SN 75451P.

Figure 6-1: Testing Unit Component Locations

7. REFERENCE DATA

Durability Test Set FBSB	B/M 02-01318-000
Schematic, Durability Test Set FBSB	02-01318-001

ITEM	QTY	DWG SIZE	PART NUMBER	ELECTRICAL SYMBOL	DESCRIPTION	CLASS 10 STOCK NUMBER	STOCK ROOM ADR	SUGGESTED SOURCE	REMARKS	REQUEST FOR PURCHASE NUMBER	DATE ORDERED	DATE REQUIRED	DATE RECEIVED
1	R	C	02-01318-001	SCHEMATIC									
2	R		" " -002	SPECIFICATIONS									
3													
4	20	C	01-16430-002	DEVICE TRAY									
5													
6	1			TEST UNIT - FURNISHED BY CUSTOMER									
7	1			ENVIRONMENTAL CHAMBER - FURNISHED BY CUSTOMER									
8	1		JQE 25-40M		POWER SUPPLY KEPCO OR EQUAL								
9													
10	20	*	Mod# 100 20.3 9-1006	K1-20	RELAY, COUNTER 18V DC COIL 6 DIGIT REDINGTON								
11	20		1116992	K21-40	" " , A/C DELCO								
12	20		MB3D12VDC	K41-60	" " , POTTER BRUMFIELD								
13	2		KC0RD	K61-K62	" " , 12V DC COIL, MA3D								
14	2		88-8	XK61-62	SOCKET, RELAY - 8 PIN OCTAL AMPHENOL								
15													
16	6		2N3724	Q1-6	TRANSISTOR - NPN TO5								
17	6		05-3301	XQ1-6	SOCKET, TRANSISTOR - 4 PIN ELCO								
18													
19	2		IN914A	CR1&2	DIODE TI								
20	1		IN4001	CR3	" TI								
21	42		1816	DS1-42	LAMP, 13V, .35 AMP CHICAGO MINIATURE	OR EQUAL							
22	42		7-20	XDS1-42	SOCKET, LIGHT BULB MIN. BAY, LEECRAFT								
		*			20 COUNTERS FOR 1ST MODEL ONLY; 2 FOR OTHERS								

SYM	REVISIONS

SYM	REVISIONS
A	15471, MC, 8-10-73, C. TALLMAN - REVISED & REDRAWN B Chandler 8/10/73

USED ON

NO DCA REQUIRED FOR REVISIONS TO RIGHT AND ABOVE DOUBLE LINE

MANUFACTURING ENGINEER	JOB NUMBER	CHARGE NUMBER	QUANTITY REQUIRED

DRAFTSMAN	B Chandler	DATE 8-8-73
DESIGNER		DATE
CHECKED		DATE
ENGINEER		DATE
APPROVED		DATE
RELEASED	B Chandler	DATE 8/10/73

TITLE

DURABILITY TEST SET

FESB

TEXAS INSTRUMENTS INCORPORATED COMPONENTS GROUP

CODE IDENTITY NUMBER	BILL OF MATERIAL	SIZE	DRAWING NUMBER	SHEET
01295		N	02-01318-000	1/2

ITEM	QTY	DWG SIZE	PART NUMBER	ELECT. SYMBOL	DESCRIPTION	CLASS 10, STOCK NUMBER OR COMMODITY CODE	STOCK RM A OR B	CUT TO PRINT	SHEET METAL	TRAY SAW	OPERATIONAL SHEETS	CUT SIZE	REMARKS	REQUEST FOR PURCHASE NUMBER	DATE ORDERED	DATE REQUIRED	DATE RECEIVED	DATE TO MACH CONTROL	DATE INSP'D O.K.
23	20		#328	DS43-G2	LAMP-6V, 200MA GE														
24																			
25	22			R1-R20 R27 & 28	RESISTOR, 15Ω, 3W, 5%														
26	6			R21-26	" " " , 1K, ½W, 10%														
27	1			R27	" " " , 100Ω, ½W, 10%														
28	1			R28	" " " , 5Ω, 3W, 5% W.W.														
29																			
30																			
31	3		SN7413	Z1-3	IC PKG. - 14 PIN DIP TI														
32	1		SN7402	Z4	" " , " " "														
33	1		SN7490	Z5	" " , " " "														
34	1		SN7492	Z6	" " , " " "														
35	2		SN7492	Z7 & Z8	" " , " " "														
36	2		SN74L42	Z9 & Z10	" " , 16 PIN " "														
37	20		SN76451P	Z11-Z20	" " , 8 PIN " "														
38	8			XZ1-8	SOCKET, IC 14 PIN														
39	12			XZ9-20	" " , " 16 PIN														
40																			
41	1		4026	T1	TRANSFORMER STANCOR														
42	1		SN72309		REGULATOR, 5V														
43	20 EACH			J1 & J2	CONNECTOR, MODULE FURNISHED BY CUSTOMER														
44	1		57-30500	P3	50 PIN. PLUG AMPHENOL														
45	1		P-12-CCT	P4	12 PIN PLUG CINCH														
46	1		57-40500	J3	50 CON. SOCKET AMPHENOL														
47	1		S-12-CCT	J4	12 CON. SOCKET CINCH														

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BILL OF MATERIAL | DEPARTMENT NO. 01295 | SIZE N | DRAWING NO. 02-01318-000 | SHEET 2/2

REVISIONS: | MICROFILMED | DOUBLE LINED AREA FOR PLANNING USE — NO ECN REQUIRED FOR REVISIONS

AMPHENOL 57-30500 P3 J3 AMPHENOL 57-40360

TO PINS 2 OF MODS 1-20

TO PINS 3 OF MODS 1-20

REPEAT CIRCUITRY 20 TIMES FOR PINS 1 THRU 20

REPEAT CIRCUITRY 20 TIMES FOR PINS 26 THRU 46

TYPICAL FBSB MODULE 1 THRU 20

J1

J2

NO START LIGHT DS1-20

R1-20 6Ω 5W

K21-40 K2-42 K1-K20

NO START RELAY

COUNTER (SEE NOTE #1)

WARNING LIGHT DS21-40

K41-60

CINCH P/HECCT P6 J6 CINCH S-8 2 CCT

TIMING CIRCUIT SHEET # 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Q1 Q2 Q4 Q5

R21 1K 1/8W

R22 4.7K 1/2W

1.5K

R23 6.8K 1/2W

1.0K

CR1 CR2

R23 1K 1/2W

Q3 Q4

DS41 SEAT BELT LIGHT

DS42 SEAT LIGHT

+16 V

.17 AMP

5 V

TO TIMING CIRCUIT

NOTES:

1. 20 COUNTERS ARE USED ON THE FIRST FACILITY BUILT. ON ALL SUCCEEDING MODELS, ONLY 8 COUNTERS ARE USED AT MODULES # 5 & 11

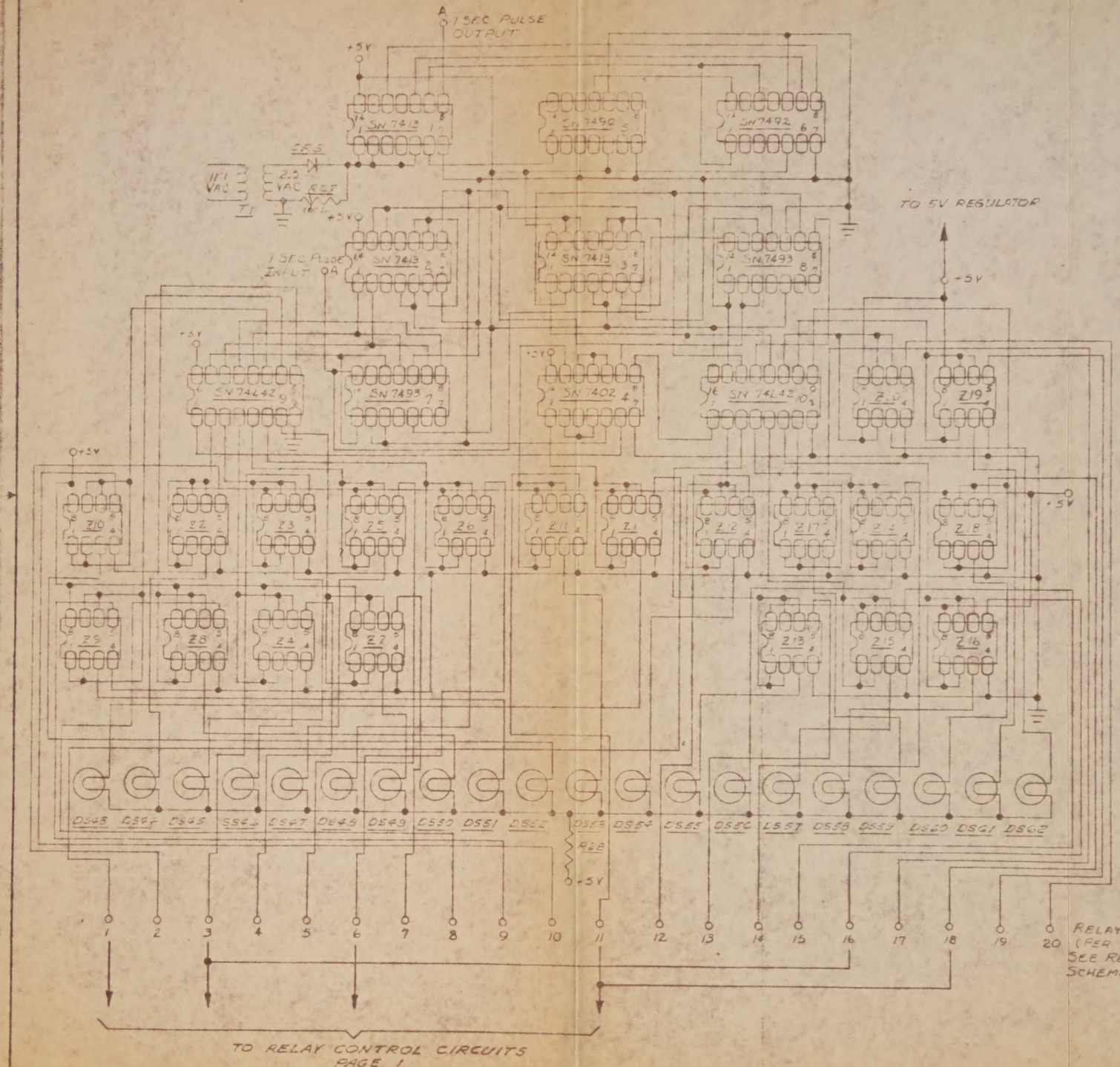
XXX ± .010
XX ± .020
X ± .030

TEXAS INSTRUMENTS

01295

SCHEMATIC - DURABILITY TEST SET FBSB

C



MATERIAL:

PROCESSES:

NEXT ASSEMBLY

TOLERANCES UNLESS SPECIFIED

.XXX ± .010
.XX ± .020
.X ± .030
ANGLES ± 1°

DRAWN McDonald 1-14-69

DESIGNED DATE

CHECKED DATE

ENGINEER DATE

APPROVED DATE

MFG. DATE

HOLE TOLERANCES

0.131" THRU	125	+.003	-.000
1/8 THRU	320	+.003	-.000
25 THRU	500	+.004	-.000
501 THRU	710	+.005	-.000
751 THRU	1000	+.006	-.000
OVER	1000	+.010	-.000

SURFACE ROUGHNESS

TEXAS INSTRUMENTS INCORPORATED COMPONENTS GROUP

CODE IDENTITY NUMBER 01295

TITLE:

SCHEMATIC - DURABILITY TEST SET FBSB

SIZE C

REVISIONS SHEET 2

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